



US009446740B2

(12) **United States Patent**
Tajima et al.

(10) **Patent No.:** **US 9,446,740 B2**
(45) **Date of Patent:** **Sep. 20, 2016**

(54) **WINDSHIELD WIPER ASSEMBLY**

(56) **References Cited**

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U.S. PATENT DOCUMENTS

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5,142,941 A * 9/1992 Amann B60S 1/0427

15/250.3

5,222,706 A * 6/1993 Hoshino B60S 1/0427

15/250.31

5,873,280 A * 2/1999 Kanazawa B60S 1/0427

15/250.3

8,819,888 B2 * 9/2014 Iizuka B60S 1/0427

15/250.27

2004/0140687 A1 * 7/2004 Kalchschmidt B60S 1/0488

296/96.17

2008/0189895 A1 * 8/2008 Bruneau B60S 1/0469

15/250.31

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 313 days.

(21) Appl. No.: **14/027,554**

FOREIGN PATENT DOCUMENTS

(22) Filed: **Sep. 16, 2013**

DE 102008041270 A1 * 2/2010

GB 2219932 A * 12/1989

(65) **Prior Publication Data**

US 2015/0074933 A1 Mar. 19, 2015

* cited by examiner

(51) **Int. Cl.**

B60S 1/06 (2006.01)

B60S 1/16 (2006.01)

H02K 5/22 (2006.01)

B60S 1/04 (2006.01)

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(52) **U.S. Cl.**

CPC **B60S 1/166** (2013.01); **B60S 1/0427**
(2013.01); **H02K 5/22** (2013.01); **B60S 1/0433**
(2013.01)

(57) **ABSTRACT**

A windshield wiper assembly for a vehicle includes a wiper
motor. The wiper motor has a housing having a top surface
and a side surface, a projection projecting from the top
surface, a mounting bracket integrally extending from the
side surface, and a rib integrally extending from the top
surface and between the projection and a longitudinal end of
the mounting bracket. Advantageously, the rib enhances the
robustness of the housing so that it is more tolerant of
stresses experienced during use.

(58) **Field of Classification Search**

CPC .. B60S 1/0419; B60S 1/0422; B60S 1/0427;
B60S 1/166; B60S 1/16; H02K 5/22; H02K
5/225

USPC 15/250.3, 250.31; 296/96.15, 96.17;
310/83, 89

See application file for complete search history.

12 Claims, 7 Drawing Sheets

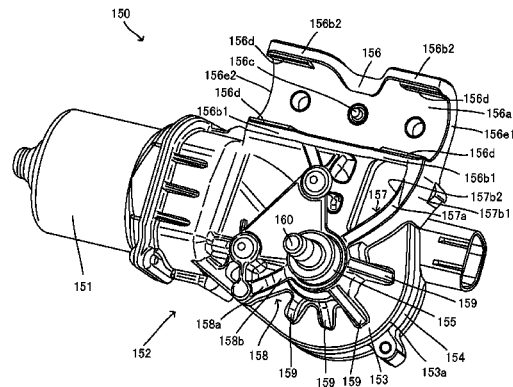
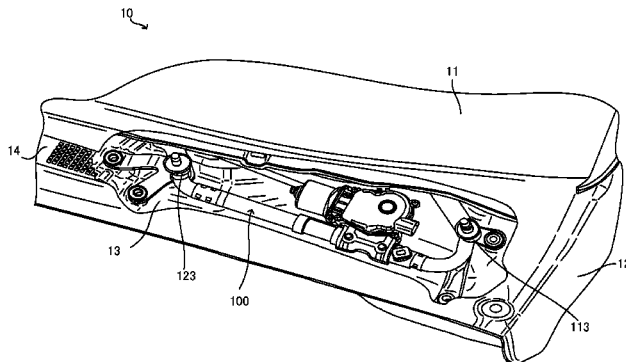


FIG. 1

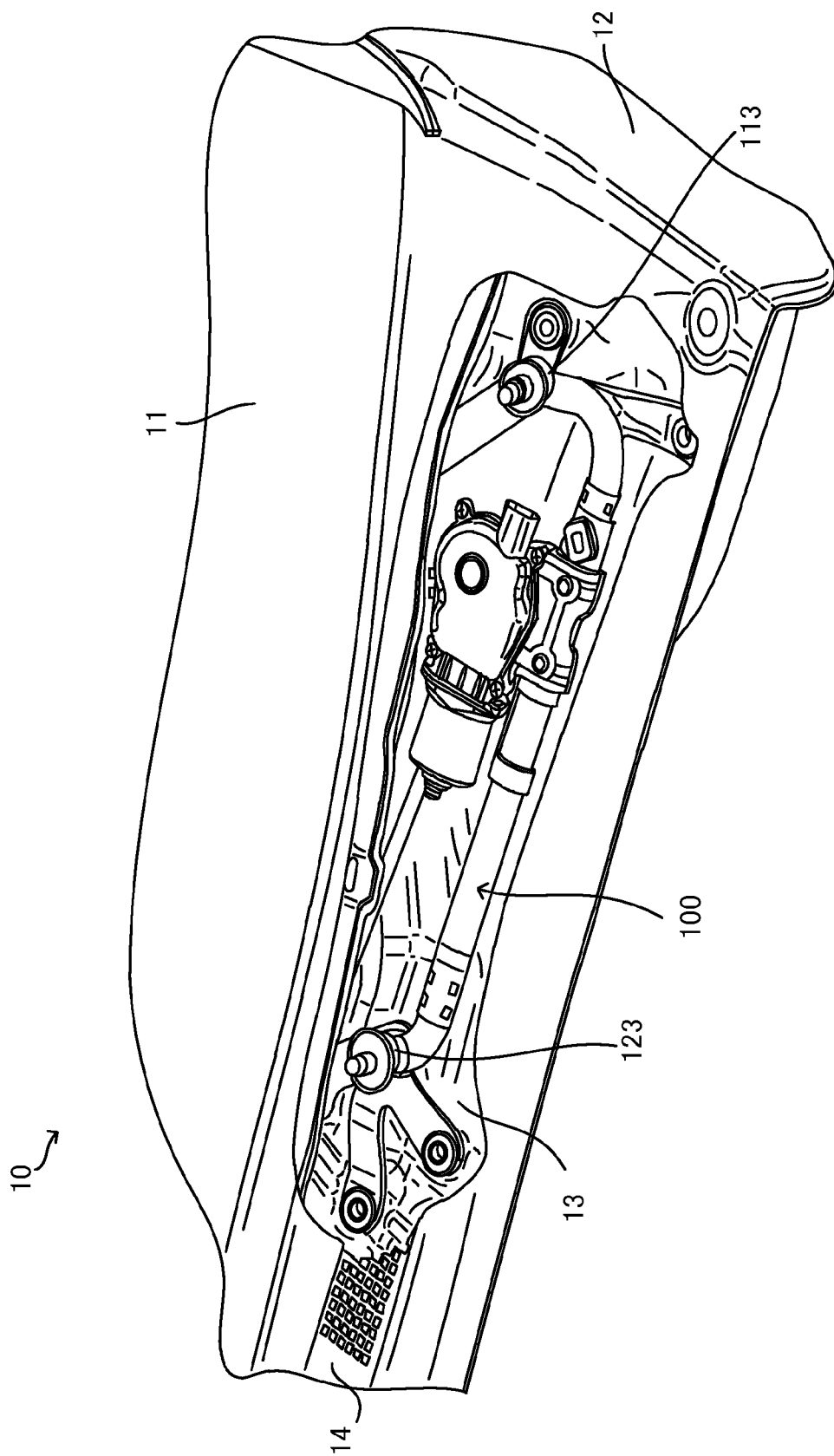


FIG. 2

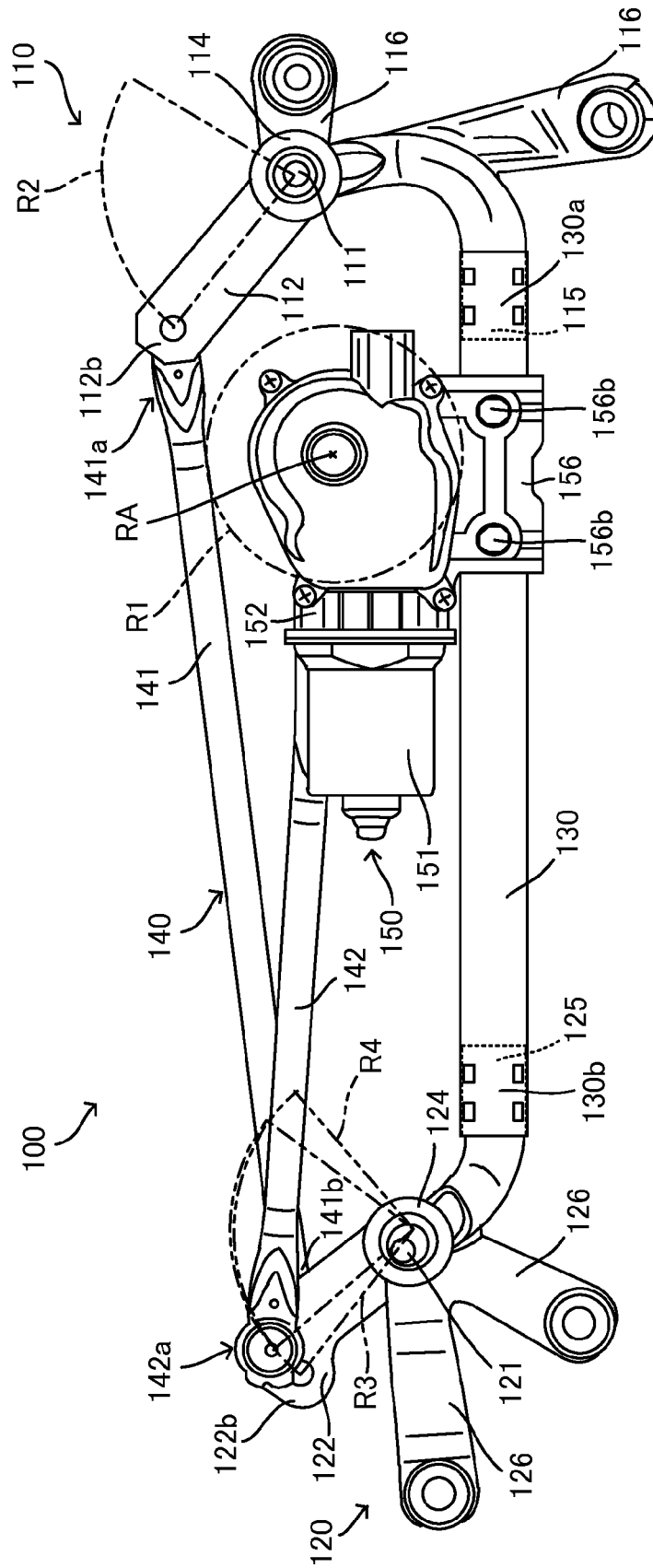


FIG. 3

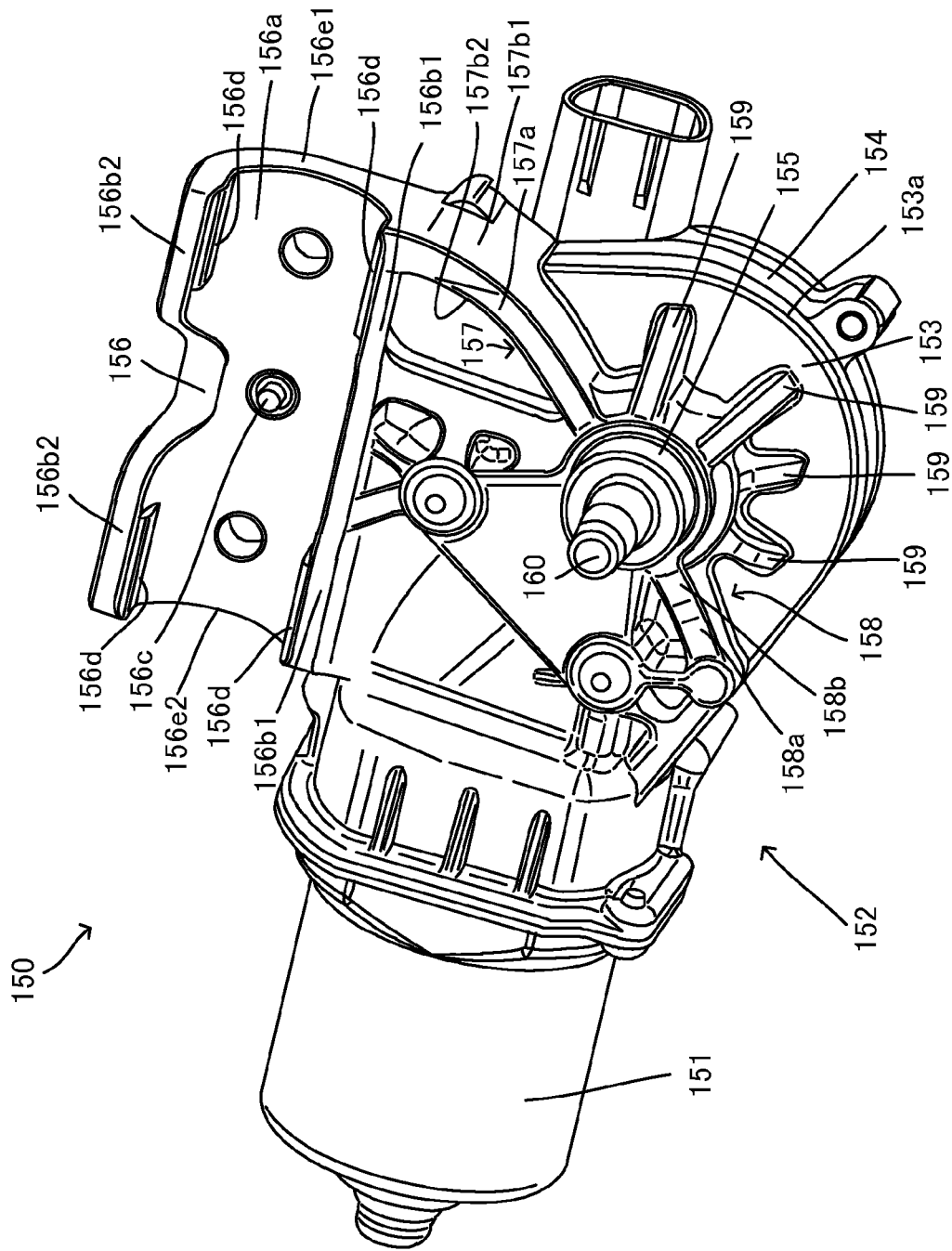


FIG. 5A

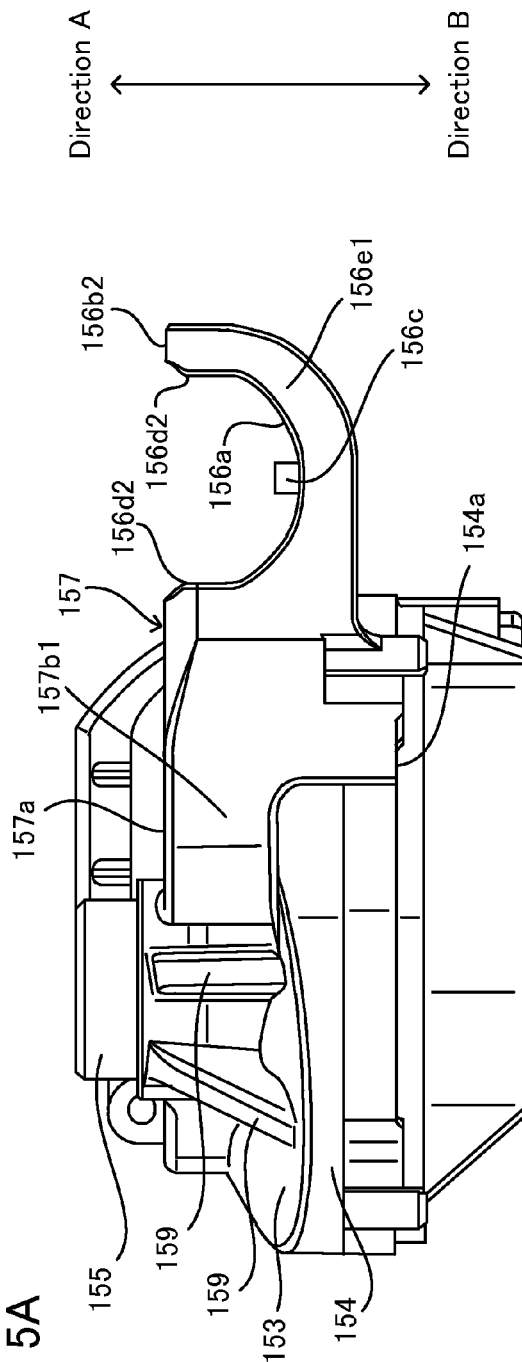


FIG. 5B

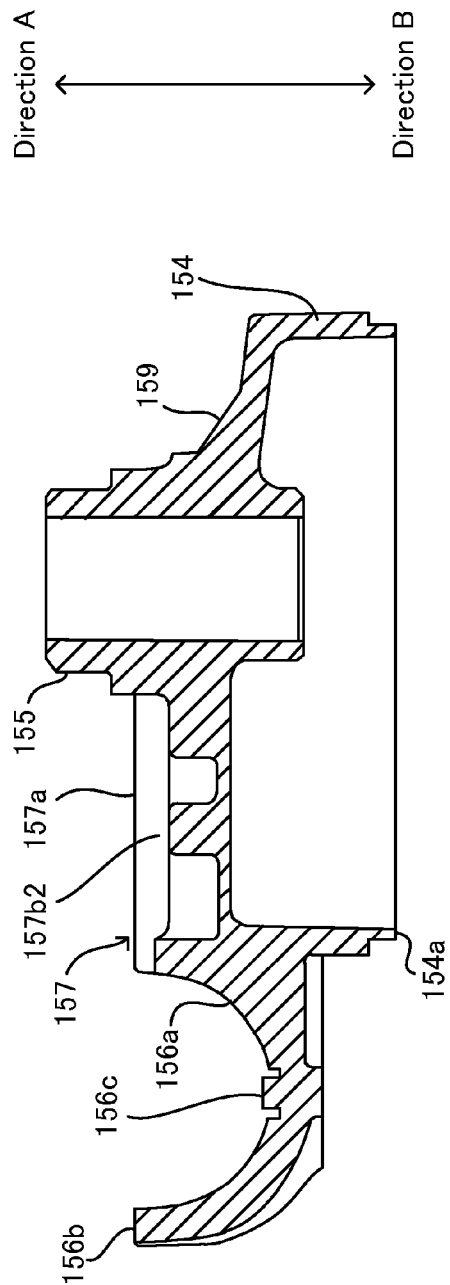
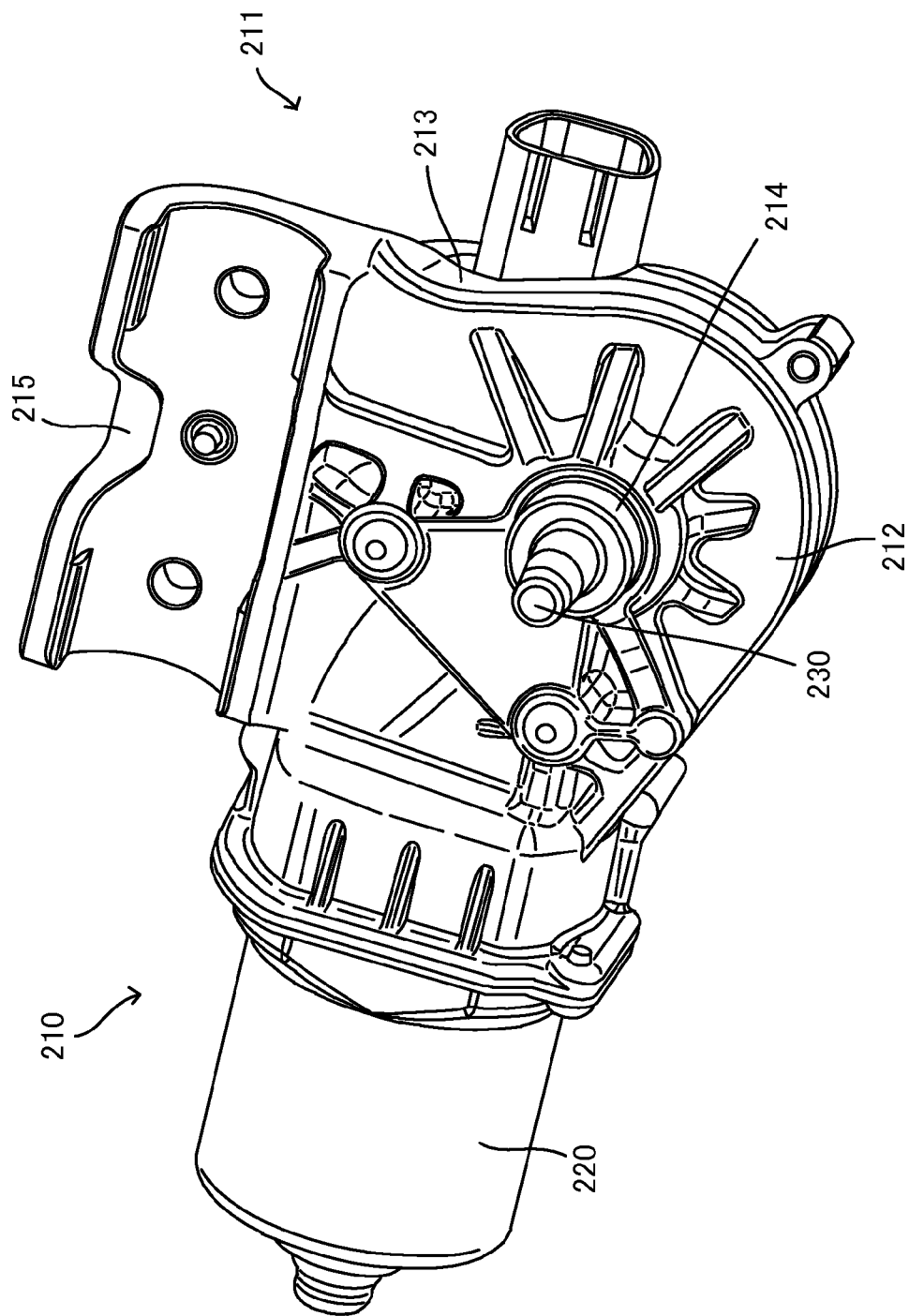


FIG. 7
RELATED ART



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WINDSHIELD WIPER ASSEMBLY

BACKGROUND

The present invention relates to a vehicle windshield wiper assembly.

Referring to FIGS. 6 and 7, a conventional windshield wiper assembly 200 typically includes a wiper motor 210, one or more wiper blades secured to wiper arms, and a pivotable linkage mechanism therebetween.

The wiper motor 210 has a housing 211 and a motor 220 which is connected to the housing 211. The housing 211 has a top surface 212 and a side surface 213. A projection 214 extends from the top surface 212. The projection 214 pivotally supports an output shaft 230 of the wiper motor 210. When the wiper motor 210 is driven, the output shaft 230 rotates in a predetermined direction r1.

The wiper motor 210 has a mounting bracket 215 integrally formed with the side surface 213. The mounting bracket 215 is attached to a bar when mounted within a vehicle. The wiper assembly 200 is mounted to the vehicle at mounting parts 250. A link mechanism 260 which is attached to the output shaft 230 moves back and forth in predetermined ranges r2, r3 and r4 due to rotation of the wiper motor 210. As a result, the wiper arms reciprocate along a windshield.

When the wiper motor 210 rotates while under the influence of obstacles such as snow, sleet, and the like at or near the end-of-stroke reverse positions, the load on the link mechanism 260 becomes high. As a result, each part of the wiper assembly 200 undergoes considerable stress. In particular, the housing 211 of the wiper motor 210 becomes highly stressed at the top surface 211, the side surface 212 and the mounting bracket 215.

SUMMARY

One aspect of the invention overcomes many limitations and disadvantages of a conventional windshield wiper assembly for use in connection with the vehicle. For example, this windshield wiper assembly includes a wiper motor including a housing having a top surface and a side surface, a projection projecting from the top surface, a mounting bracket integrally extending from the side surface, and a rib integrally extending from the top surface and from the projection to a longitudinal end of the mounting bracket. Advantageously, by having the rib on the housing, the housing is more robust and stress resistant than the conventional windshield wiper assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a cut away cowl cover plate which shows a windshield wiper assembly in the mounted state according to an embodiment of the present invention.

FIG. 2 is a front view of a wiper windshield assembly according to an embodiment of the present invention.

FIG. 3 is a perspective view of a wiper motor of the present invention.

FIG. 4 is a perspective view of a gear housing of the wiper motor to the present invention.

FIG. 5A is a side view of the gear housing as seen from the direction of an arrow 5A in FIG. 4.

FIG. 5B is a sectional view of the gear housing taken along line 5B-5B in FIG. 4.

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FIG. 6 is a front view of a windshield wiper assembly according to the related art.

FIG. 7 is a perspective view of a wiper motor according to the related art.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

Embodiments of the invention will be explained with reference to the drawings.

As shown in FIG. 1, a vehicle 10 includes a windshield 11 and a body panel 12. The body panel 12 includes a cowl box 13 and a cowl cover plate 14 which covers the cowl box 13. A windshield wiper assembly 100 is mounted within the cowl box 13.

As shown in FIGS. 1 to 3, the wiper assembly 100 includes a first pivot assembly 110, which includes a first pivot shaft 111, a first pivot lever 112, a first shaft supporting portion 113, a first pivot cap 114, a first bar coupling portion 115, and first body mounting parts 116, 116.

Also, the wiper assembly 100 includes a second pivot assembly 120, which includes a second pivot shaft 121, a second pivot lever 122, a second shaft supporting portion 123, a second pivot cap 124, a second bar coupling portion 125, and second body mounting parts 126, 126. Further, the wiper assembly 100 includes a bar 130 and a link mechanism 140.

Details of each of these structures are described below.

The first and second pivot shafts 111 and 121 are preferably formed of metal, and have an elongated cylindrical shape. The first and second pivot levers 112 and 122 are preferably formed of metal, and have a rectangular and thin plate shape.

A first end of the first pivot shaft 111 is coupled to a first end of the first pivot lever 112. A first end of the second pivot shaft 121 is coupled to a first end of the second pivot lever 122.

The first and second shaft supporting portions 113 and 123 are preferably formed of metal or plastic, and have a cylindrical bore shape. The first pivot shaft 111 is inserted into the first shaft supporting portion 113 so that the first pivot shaft 111 is pivotally supported by the first shaft supporting portion 113. The second pivot shaft 121 is also inserted into the second shaft supporting portion 123 so that the second pivot shaft 121 is pivotally supported by the second shaft supporting portion 123.

The first pivot cap 114 is attached to the first pivot shaft 111 or the first shaft supporting portion 113 so that grease is encased by the first pivot cap 114. The second pivot cap 124 is attached to the second pivot shaft 121 or the second shaft supporting portion 123 so that grease is encased by the second pivot cap 124. By providing the first and second pivot caps 114 and 124, fluid (e.g., rain water, melting snow, washing fluid, and the like) is prevented from splashing on or encroaching between the first pivot shaft 111 and the first shaft supporting portion 113, and between the second pivot shaft 121 and the second shaft supporting portion 123.

The first and second bar coupling portions 115 and 125 are preferably formed of metal or plastic, and are integrally formed with the first and second shaft supporting portions 113 and 123 so that they project outwardly from the sides of the first and second shaft supporting portions 113 and 123. The first and second bar coupling portions 115 and 125 are generally an elongated cylinder, for example, 23 mm in diameter, with a circular cross-section, and are coupled to both ends of the bar 130 by any suitable method of mounting such as press-fitting, swaging, or via threaded fasteners.

The first and second body mounting parts **116** and **126** are preferably formed of metal or plastic, and are integrally formed with the first and second shaft supporting portions **113** and **123**. The first and second body mounting parts **116** and **126** are mounted on the cowl box **13** by, for example, bolts. As such, the first and second bar coupling portions **115** and **125** are maintained stationary relative to the cowl box **13** while the first and second pivot levers **112** and **122** are pivotable about the first and second pivot shafts **111** and **121**.

The bar **130** is preferably formed of metal, and is generally an elongated straight cylinder, for example, 25 mm in diameter, with a circular cross-section that is cut to a predetermined length, for example, 300 mm.

The first bar coupling portion **115** is coupled to a first end **130a** of the bar **130** by, for example, press-fitting or swaging. Also, the second bar coupling portion **125** is coupled to a second end **130b** of the bar **130** by, for example, press-fitting or swaging.

As illustrated, the first and second bar coupling portions **115** and **125** may be inserted within both ends to enhance the interconnection therebetween.

As shown in FIG. 2, the link mechanism **140** includes first and second link rods **141** and **142**. The first and second link rods **141** and **142** are preferably formed of metal although other materials may substitute therefor. The link mechanism **140** is pivotally connected to the first and second pivot levers **112** and **122**.

As shown in FIG. 2, the second end **112b** of the first pivot lever **112** is pivotally connected to a first end **141a** of the first link rod **141**. The second end **122b** of the second pivot lever **122** is pivotally connected to a second end **141b** of the first link rod **141**. The second end **122b** of the second pivot lever **122** is pivotally connected to a first end **142a** of the second link rod **142**.

As shown in FIGS. 2 to 5B, the wiper motor **150** includes a motor **151**, and a housing **152** which is coupled to the motor **151**. The wiper motor **150** is directly mounted on one side of the bar **130**, and between the first and second bar coupling portions **115** and **125** by, for example, bolts and nuts. When the wiper motor **150** rotates in the predetermined range R1, the first and second levers **112** and **122** move in predetermined ranges R2, R3 and R4. Further, the first and second link rods **141** and **142** move back and forth with the first and second levers **112** and **122**.

The housing **152** is preferably formed of metal or plastic, and is integrally formed with a top surface **153**, a side surface **154**, a projection **155** and a mounting bracket **156**. The top surface **153** has a shape which is a combination of a semicircle and a square.

The top surface **153** includes a projection **155** which has a longitudinal cylindrical bore extending therethrough. As shown in FIGS. 5A and 5B, a first direction A is defined as a top direction for providing relative orientation of the top surface **153** in FIG. 5A. In this case, the direction A is defined as a direction which the projection **155** extends from the top surface **153**. Also, a second direction B is defined as a bottom direction and is in an opposite direction relative to the first direction A. The side surface **154** extends from the edge of the top surface **153** in the second direction B.

The projection **155** is integrally formed with the housing **152**. The projection **155** has a longitudinal cylindrical shape and extends from the top surface **153** in the first direction A. The projection **155** pivotally supports an output shaft **160**. The projection **155** has, for example, a height of approximately 26 mm from the top surface **153**.

The mounting bracket **156** is integrally formed with the housing **152** and is mounted to the bar **130**. The mounting

bracket **156** extends from the side surface **154**. The mounting bracket **156** includes a generally semicylindrical surface **156a**. The bar **130** is mounted onto the semicylindrical surface **156a**, secured the mounting bracket **156** to the bar **130** by bolts **156b** and nuts.

The mounting bracket **156** includes first and second top end surfaces **156b1** and **156b2** which lay in a plane perpendicular to the first direction A. The first top end surface **156b1** is located next to the side surface **154**. The second top end surface **156b2** is spaced apart from the first top end surface **156b1**. An inside edge of the second top end surface **156b2** is approximately 25.1 mm from an inside edge of the first top end surface **156b1**.

Further, the mounting bracket **156** includes first and second longitudinal end surfaces **156e1** and **156e2**. The first and second longitudinal end surfaces **156e1** and **156e2** lay in planes perpendicular to the longitudinal direction of the mounting bracket **156**.

The first longitudinal end surface **156e1** is located near the side surface **154**. The second longitudinal end surface **156e2** is located on the opposite side of the mounting bracket **156** relative to the first longitudinal end surface **156e1**. The first longitudinal end surface **156e1** is approximately 77 mm from the second longitudinal end surface **156e2**.

As shown in FIGS. 3 to 5B, the mounting bracket **156** also includes a boss **156c** on the semicylindrical surface **156a**. The boss **156c** is located at a center of a long side of the mounting bracket **156**. The boss **156c** extends from the semicylindrical surface **156a** in the first direction A. The boss **156c** has a height of approximately 3 mm from the semicylindrical surface **156a**. The boss **156c** is approximately 62 mm from the center axis of the projection **155**. When the bar **130** is mounted on the mounting bracket **156**, the boss **156c** inhibits longitudinal movement of the bar **130**.

The mounting bracket **156** includes four projections **156d** on the semicylindrical surface **156a**. Each projection **156d** is located at a corner among the first and second top end surfaces **156b1** and **156b2** and the first and second longitudinal end surfaces **156e1** and **156e2**. The projections **156d** contact with an outer periphery of the bar **130**. The projections **156d** prevent the bar **130** from rotating relative to the mounting bracket **156**.

A rib **157** extends from the projection **155** to the mounting bracket **156** and extends from the top surface **153** of the housing **152** in the first direction A. The rib **157** includes a top end **157a** and first and second side surfaces **157b1** and **157b2**.

The top end **157a** has a plane perpendicular to the first direction A. The top end **157a** of the rib **157** and the first top end surface **156b1** of the mounting bracket **156** are preferably co-planar. The top end **157a** has a height of approximately 13 mm from the top surface **153**. The top end **157a** has a constant width of approximately 5 mm. The first side surface **157b1** extends from the top end **157a** to an end surface **154a** of the side wall **154** in the direction B. The first side surface **157b1** has a height of approximately 28.5 mm from the top end **157a** to the end surface **154a**. The first side surface **157b1** has two heights of approximately 13 mm and 28.5 mm. The rib **157** is integrally formed with the mounting bracket **156**. The first side surface **157b1** is located on the side of a border between the top surface **153** and the side surface **154**. The second side surface **157b2** is located on an opposite side of the first side surface **157b1**. The first and second side surfaces **157b1** and **157b2** are parallel curves. The first side surface **157b1** has a radius of approximately 35 mm. The second side surface **157b2** has a radius of approxi-

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mately 30 mm. The first side surface **157b1** is approximately 5 mm from the second side surface **157b2**.

The first side surface **157b1** is coextensive with the longitudinal end surface **156e1**. The rib **157** also extends from the top surface **153** to the end surface **154a**. The first side surface **157b1** has a common surface with the first longitudinal end surface **156e1**.

The opposite rib **158** is located at an opposite side of the rib **157** and is essentially aligned therewith. The opposite rib **158** includes a first opposite rib **158a** having a common plane with the top end **157a**, and a second opposite rib **158b** which inclines from the projection **155** to the first opposite rib **158a**. The first opposite rib **158a** has a constant width of approximately 5.5 mm. The first opposite rib **158a** has a height of approximately 7.5 mm from the top surface **153**. The second opposite rib **158b** has an angle of approximately 155 degrees relative to the first opposite rib **158a**. The opposite rib **158** extends from the projection **155** to the housing edge **153a**.

Reinforcement ribs **159** are located on the top surface **153**. The reinforcement ribs **159** extend radially outwardly from the projection **155** in a spoke-like manner. The reinforcement ribs **159** integrally extend from the top surface **153** in the first direction A, and radially extend around the projection **155** between the rib **157** and the opposite rib **158**. In this embodiment, the reinforcement ribs **159** include four ribs and extend from the projection **155** at angles about equal to adjacent ribs **159**. Each of the reinforcement ribs **159** has a generally triangular bar shape. Each reinforcement rib **159** has an angular range from about 20 degrees to about 45 degrees. Each reinforcement rib has a width of approximately 5 mm.

When the wiper motor **150** rotates in the presence of obstacles (e.g., snow and the like) at or near the end-of-stroke reverse positions, the housing **152** of the wiper motor **150** is resistant to high stresses among the top surface **153**, the side surface **154** and the mounting bracket **156**.

The windshield wiper assembly being thus described, it will be apparent that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be apparent to one of ordinary skill in the art are intended to be included within the scope of the following claims.

What is claimed is:

1. A windshield wiper assembly, comprising:
 - a housing having a top surface and a side surface;
 - a projection projecting in a first direction from the top surface, the projection having a through hole at a center of the projection, a longitudinal axis of the through hole being parallel to the first direction;
 - a mounting bracket integrally extending from the side surface, the mounting bracket having:
 - a first end boated at the side surface, the first end having:
 - a first top end surface; and
 - first and second longitudinal end surfaces opposite to each other;

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a second end located away from the side surface, the second end having:

- a second top end surface; and
- the first and second longitudinal end surfaces; and
- a semi-cylindrical bottom connecting between the first and second ends, the semi-cylindrical bottom including the first and second longitudinal end surfaces; and

a first rib integrally extending from the top surface in the first direction, the first rib integrally extending from a side of the projection to the first top end surface and the first longitudinal end surface of the mounting bracket in a first rib extending direction,

wherein the rib has a constant height relative to the top surface from the side of the projection to the mounting bracket.

2. The windshield wiper assembly according to claim 1, wherein the first rib has a planar top surface.
3. The windshield wiper assembly according to claim 1, wherein the first rib has a top planar surface that has an equal height with the first top end surface of the mounting bracket relative to the top surface.
4. The windshield wiper assembly according to claim 1, wherein the first rib curves between the side of the projection and the mounting bracket in a plan view.
5. The windshield wiper assembly according to claim 1, wherein the first rib has first and second rib side surfaces, and the first rib side surface is coextensive with the first longitudinal end surface of the mounting bracket.
6. The windshield wiper assembly according to claim 5, wherein the first rib side surface has a rib bottom end surface, the first rib side surface extends in a second direction from the top surface of the housing so that the rib bottom end surface is shallower than the top surface of the housing.
7. The windshield wiper assembly according to claim 6, wherein the rib bottom end surface is perpendicular to the longitudinal axis of the through hole of the projection.
8. The windshield wiper assembly according to claim 7, wherein the rib end surface is shallower than the semi cylindrical bottom of the mounting bracket.
9. The windshield wiper assembly according to claim 1, further comprising:
 - an opposite rib integrally extending from the top surface of the housing in the first direction, the opposite rib integrally extending from the side of the projection in an opposite rib extending direction opposite to the first rib extending direction.
10. The windshield wiper assembly according to claim 9, wherein the opposite rib has a top surface in a common plane with a top surface of the first rib.
11. The windshield wiper assembly according to claim 1, wherein the first rib extends to a housing bottom end of the side surface of the housing.
12. The windshield wiper assembly according to claim 1, wherein the mounting bracket is mounted to a bar so that the semi-cylindrical bottom of the mounting bracket abuts the bar.

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